Claims

1. Radioactive radiation source for brachytherapy having an elongated radiation emitting element (1) within an elongated means for containment (2) such that the longitudinal axis of the radiation emitting element and the longitudinal axis of said means for containment are aligned, said means for containment comprising a shielding section (3) and a radiation transition section (4),
   - said shielding section (3) covering said radiation emitting element at least partially to substantially attenuate any radiation emitted in the direction of said shielding section,
   - said radiation transition section (4) extending substantially along the longitudinal axis of the means for containment and comprising a shielding material (5),
   - which shielding material (5) is so adapted as to attenuate the radiation emitted from said radiation emitting element such that, in a plane at a pre-selected distance from the radiation source, a substantially uniform radiation dose is received over a target area (6) having a length substantially larger than the longitudinal axis of the elongated means for containment, and preferably also a diameter substantially larger than the diameter of the means for containment.

2. Radiation source according to claim 1, wherein said shielding section (3) and said radiation transition section (4) form integral parts of the means for containment (2).

3. Radiation source according to claim 1, wherein said means for containment (2) comprises a first layer or capsule (2a), which layer or capsule sealingly encloses the radiation emitting element (1), and further comprises a shielding section (3) and a radiation transition section (4) which are provided separately from said first layer or capsule (2a) on the outside or inside thereof.

4. Radiation source according to claim 1, wherein said shielding material (5) is adapted by varying its thickness, density and/or composition.

5. Radiation source of claim 4, wherein the shielding material (5) is provided in a greater thickness in such portions of the radiation transition section (4) closer to the target area (6).

6. Radiation source of claim 5, wherein the shielding section (3) covers the radiation emitting element (1) over the full length of its longitudinal axis on at least one side of the element.

7. Radiation source of claim 6, wherein the radiation transition section (4) is located on the side of the radiation emitting element opposite to the shielding section (3).

8. Radiation source of claim 5 or claim 6, wherein the shielding material (5) is provided with a greater shielding capacity, preferably in a greater thickness, centrally over and along the longitudinal axis of the radiation emitting element on the part of the source intended directly to oppose the target area.

9. Radiation source according to claim 8, wherein said shielding material (5) comprises recesses (7), in particular recessed windows, on such portions of the radiation transition section (4) further from the target area (6).

10. Radiation source according to one of claims 1 to 3, wherein as said shielding material (5) is adapted by varying its shielding effect through varying its density and/or composition.

11. Radiation source of claim 10, wherein a material with a higher shielding effect is used in such portions of the radiation transition section (4) closer to the target area (6), while in such portions of the radiation transition section (4) further from the target area (6) a material with a lower shielding effect is used.

12. Radiation source according to one of the claims 1 to 11, wherein said radiation source further comprises a cover sleeve enclosing the means for containment.

13. Radiation source according to one of the claims 1 to 12, wherein the radiation emitting element is provided in tubular or cylindrical form or is comprised of one or more than one spherical elements.

14. Radiation source according to one of the claims 1 to 13, wherein the radiation emitting element is a beta-radiation emitting element which preferably comprises a nuclide having a max. particle energy of β-radiation of at least 500 keV.

15. Radiation source according to one of claims 1-13 wherein the radiation emitting element comprises a nuclide selected from the group consisting of Y-90, Sr-90/Y-90, Tm-170, P-32, Cl-36, Ce-144/Pr-144, Tb-160, Ta-182, Tl-204, Sn-123, Re-188, Ir-192 and Se-75.

16. Radiation source according to claim 14, wherein the radiation emitting element comprises Sr-90/Y-90 or Y-90 in a metallic, plastic or ceramic matrix or supported on a carrier.

17. Radiation source according to one of the claims 1 to 16, wherein the shielding section (3) comprises a metallic material selected from high Z metals, preferably selected from the group consisting of Pt, Pd, Au, Ag, Ir, Pb, W and their alloys, compounds, and composites and mixtures thereof.

18. Radiation source according to one of the claims 1 to 17, wherein the means for containment (2, 2a) comprises a metallic or plastic material, preferably selected from the group consisting of Al, Ag, Au, Pb, Cd, Ce, Cr, Co, Cu, Fe, Hg, Hf, Bi, In, Mg, Mn, Mo, Nb, Ni, Pd, Pt, Pr, Re, Rh, Sn, Si, Ta, Ti, Tb, Th, V, W, Y, Yb, Zn, Zr and their alloys, compounds, and composites and mixtures thereof.

19. Radiation source of claim 1, wherein the beta-radiation emitting element (1) is a wire comprising an oxide or salt of Sr-90/Y-90 or Y-90 within a metallic matrix; said means for containment (2) comprises a first sealed metallic cylinder (2a) made

of stainless steel, Ti or an alloy comprising Ti; a second cylinder made of an Pt/Ir-alloy being provided around said first cylinder, the first halfcircle of the second cylinder around the first cyliner forming said shielding section (3); and the second halfcircle of the second cylinder around the first cylinder forming the radiation transition section (4) by varying the wall thickness of the second cylinder in the second halfcircle, and wherein a cover sleeve is provided in form of a third sealed cylinder made of stainless steel, Ti or a Ti-alloy enclosing the other components of the source.

20. Radiation source of claim 1, wherein the beta-radiation emitting element (1) comprises an oxide or salt of Sr-90/Y-90 or Y-90 in a metallic matrix' sealed within a means for containment provided in form of a first sealed cylinder made of stainless steel, Ti or a Ti-alloy enclosing the radiation emitting element; said the source further comprising a second cylinder made of an Pt/Ir-alloy provided around said first cylinder, the first halfcircle of the second cylinder around the first cyliner forming said shielding section (3), and the second halfcircle of the second cylinder around the first cylinder forming the radiation transition section (4), the shielding material (5) being provided by varying the wall thickness of the second cylinder in the second halfcircle.

21. A method of manufacture of a radiation source according to one of claim 1 to 20, including the steps of:

- providing a radioactive radiation source for brachytherapy having an elongated radiation emitting element (1) within an elongated means for containment (2) such that the longitudinal axis of the radiation emitting element and the longitudinal axis of said means for containment are aligned
- providing a shielding section (3) and a radiation transition section (4),
- said shielding section (3) covering said radiation emitting element at least partially to substantially attenuate any radiation emitted in the direction of said shielding section,

- said radiation transition section (4) extending substantially along the longitudinal axis of the means for containment and comprising a shielding material (5),

by adapting the shielding material (5) as to attenuate the radiation emitted from said radiation emitting element such that, in a plane at a pre-selected distance from the radiation source, a substantially uniform radiation dose is received over a target area (6) having a length substantially larger than the longitudinal axis of the elongated means for containment, and preferably also a diameter substantially larger than the diameter of the means for containment.

22. A method of claim 21, wherein the step of adapting the shielding material (5) is by varying its thickness, density and/or composition.

23. A method of claim 21 or 22, wherein the shielding material (5) is provided with a greater shielding capacity, preferably in a greater thickness, centrally over and along the longitudinal axis of the radiation emitting element on the part of the source intended directly to oppose the target area.

24. A method of one of claims 21 to 23, wherein said shielding material (5) comprises recesses (7), in particular recessed windows, on such portions of the radiation transition section (4) further from the target area (6).